The Use of Smart Home Technologies: Cognitive Dissonance Perspective

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Abstract

Smart homes deliver services that help people in their daily routine and bring societal benefits. Despite the importance of smart homes for users, the utilisation of the technology is under-researched, especially in the event of the technology not performing as expected. This study adopts the cognitive dissonance theory to examine a) cognitive inconsistency and emotions associated with disconfirmed expectations of smart home technology performance, and b) the strategy that people use to reduce this inconsistency. To test the research model, we used the data of 474 former and current users of smart homes, which was collected through an online survey. The findings of the study confirm the positive relationships of dissonance with feeling anger, guilt and regret. It was found that cognitive dissonance reduction was predicted by the feeling of guilt and negatively affected by the feeling of regret. A positive correlation of dissonance reduction and satisfaction with purchase decision and technology performance was established. The results contribute to the technology acceptance and cognitive dissonance literature by providing evidence about the behaviour of users when the technology performance does not meet expectations, shedding light on the interrelationship between cognitive dissonance arousal, negative emotions and dissonance reduction.

Keywords: cognitive dissonance, satisfaction, smart home, technology acceptance

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1. Introduction

A smart home is a residence embedded with smart technologies aimed at delivering tailored services to home inhabitants (Marikyan et al., 2019). The objective of implementing smart home technologies is to help people in their daily routine and deliver environmental, financial, health-related and psychological benefits (Marikyan et al., 2019). Despite the personal and societal benefits that smart homes are able to provide, the adoption of this technology is still low. This indicates the need for an empirical insight into the usage of technology from the users' perspective.

The literature on the adoption of technology provides scarce evidence. First, research predominantly focuses on the variables that affect behavioural intention or underpin the actual usage of technology. For example, numerous studies use the constructs from the technology acceptance model, the unified theory of acceptance and use of technology or the theory of planned behaviour (Im et al., 2011, Awa et al., 2015) to examine how attitudinal and behavioural factors affect the perceived performance of technology and the intention to use. However, there is a lack of studies that examine the behaviour of users when technology does not meet initial expectations. Second, the current literature focuses mostly on the variables specific to information systems research, such as technology performance, task-technology fit (Wu and Chen, 2017, Marikyan et al., 2020), while overlooking the psychological factors that play an important role in the behaviour of users. Given the above gaps, the objective of this study is to examine affective responses as well as associated cognitive factors, following the dissatisfaction with the use of smart home technology.

2. Theoretical Foundation and Hypothesis Development

2.1. Smart Homes

A smart home is defined as "*a residence equipped with computing and information technology, which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond*" (Aldrich, 2003). Smart homes offer five main types of services, namely support, monitoring, the delivery of therapy, the provision of comfort and consultancy (Chang et al., 2009, Alam et al., 2012). These services facilitate sustainable development and users' wellbeing (Wong and Li, 2008) by addressing the environmental, social and economic needs of society (Li et al., 2016). In terms of environmental value, the utilisation of environment monitoring systems (e.g. smart lighting, gas, energy management) and smart home appliances (e.g. smart refrigerators, dishwashers, locks, doors) offers comfort, consultancy and monitoring services (Alam et al., 2012, Chan et al., 2008). Social value is reflected in the promotion of the physical and psychological wellbeing of people in need through access to remote health therapy and virtual interaction, support in independent living, monitoring of health conditions and the provision of consultancy (Alam et al., 2012, Peetoom et al., 2015, Chang et al., 2009). Economic value is achieved by transforming traditional healthcare to homecare and taking advantage of smart lighting and energy management systems, which enable users to reduce spending on resource consumption and physical visits to a doctor (Marikyan et al., 2019).

Although smart homes promise benefits that can address the needs of wide user segments, the adoption of the technology is still low (Marikyan et al., 2019). The adoption rate can be explained by perceived risks and challenges, which relate to technological, financial ethical and legal issues and knowledge gaps. Technologically, smart homes are not easy to use, control, maintain and integrate with other technologies (Balta-Ozkan et al., 2014). Also, evidence suggests that users' expectations about the energy efficiency of smart home devices are sometimes not fulfilled (e.g. (Hargreaves et al., 2018)). This indicates the existence of an expectation-performance gap, which may inhibit the wider adoption of the technology. However, smart home literature lacks insight into the behavioural consequences of users' disconfirmed expectations. Hence, the following sections provide a review of the literature on technology adoption and discuss the Cognitive Dissonance Theory to understand users' behavioural patterns when technology performance falls short of expectations.

2.2. Cognitive Dissonance

The research model for this study is based on cognitive dissonance theory. This theory postulates that a state of dissonance is triggered when an individual possesses two or more contradictory cognitions. Dissonance transforms into emotional and psychical discomfort until the individual starts resolving the aroused dissonance (Festinger, 1962). The model of cognitive dissonance can be presented as a four-stage process. First, a contradiction of cognitions occurs, (e.g. service expectation vs service perception), which causes dissonance. Second, dissonance, induced by disconfirmed expectations, triggers the psychological state associated with negative emotions and discomfort. Third, this affective state influences the motivation of individuals to resolve the aroused dissonance (Festinger, 1962, Sweeney et al., 2000). To reduce dissonance, individuals can undertake a number of measures. One of the main measures is attitude change (Festinger, 1962). This is defined as the modification of initial expectations or the perception of performance (O'Neill M, 2004, Festinger, 1962, Harmon-Jones and Harmon-Jones, 2007). Individuals' preferences towards a specific choice are strengthened and alternatives are rejected, increasing the consonant state of mind. Attitude change represents the post-factum justification of the product purchase or the rationalisation of the product performance, which are aimed at maintaining the integrity of our own decisions and their outcomes (Stephens, 2017, E. Ashforth et al., 2007, Harmon-Jones and Harmon-Jones, 2007). The fourth stage is the outcome of cognitive dissonance reduction. In the context of smart home technology use, the disconfirmed expectations about smart home technology performance raise the dissonance and associated negative emotions, motivating people to reduce the dissonance and achieve decision/use satisfactions.

2.3. Disconfirmation of Expectations

Drawing on the theory of expectation-confirmation (Bhattacherjee, 2001, Dai et al., 2015), before finalising the purchase of the service/product, individuals hold a certain level of expectations about the selected product/service. After using the product/service, individuals start evaluating the performance and comparing it with pre-purchase expectations. The evaluation of pre-purchase expectations with actual performance can lead either to confirmation (positive) or disconfirmation (negative) of the expectation, whereby the latter effect fuels the arousal of dissonance (Festinger, 1962). The disconfirmation-dissonance relationship has been empirically confirmed in studies in the information systems domain (Park et al., 2015) It was confirmed that dissonance originated from the inconsistency

between the pre-service and post-service performance of online systems (Park et al., 2015). Similarly, the disconfirmed expectations about smart home technology performance are assumed to trigger dissonance, due to the discrepancy between pre- and post-performance evaluation.

H1: *The disconfirmation of smart home performance with prior expectations has a positive effect on dissonance arousal.*

2.4. Cognitive Dissonance and Emotions

Cognitive dissonance theory postulates that dissonance is associated with an affective state, such as discomfort and uneasiness (Festinger, 1962). Drawing on past research, there are three main types of emotions that can be associated with cognitive dissonance.

The first is anger (Harmon-Jones, 2004). Anger is defined as a basic emotion, holding a number of other underlying similar yet slightly different emotions, like frustration, irritation or bitterness (Shaver et al., 1987). Anger usually occurs in situations when the party other than oneself is responsible for harm or misdeeds (Smith and Lazarus, 1993). For example, it was found that people who report the experience of higher cognitive dissonance have a stronger perception of anger and aggression (Soutar and Sweeney, 2003). Similarly, it can be suggested that individuals experiencing dissonance caused by disconfirmed expectations of smart home technology performance are more likely to experience anger.

The second emotion which can be associated with cognitive dissonance is guilt (Gosling et al., 2006, Turel, 2016). Guilt results from the violation of personal internal standards and values. Usually, guilt is experienced when the person has control over the behaviour causing guilt. Unlike anger, guilt is experienced when a person feels responsible for the behaviour causing the inconsistency with internal norms (Burnett and Lunsford, 1994). Guilt has been used to explain the psychological state between cognitive dissonance and discontinuous use intention in the context of information technology use. It was found that IT addiction raises a self-attributed negative emotion (i.e. guilt), which suggests that a person is not capable of rationally utilising the technology and realising the desired goals (Vaghefi and Qahri-Saremi, 2017). In line with prior research (Gosling et al., 2006, Turel, 2016) , when people feel responsible for the failure of smart home technology performance, they can feel guilt.

The third emotion related to dissonant situations is regret (Roese and Summerville, 2005). Regret is a negative emotion which reflects self-blame for behaviours that should not have taken place (Connolly and Zeelenberg, 2002). Regret has received a great deal of attention from decision making theorists and scholars (Gilovich et al., 1995a, Gregory-Smith et al., 2013). It is considered that regret is experienced when the person has the opportunity for alternative action, which may bring positive results. The intensity of regret is higher in the condition of a higher perceived opportunity (Roese and Summerville, 2005). Given the above:

H2: *Dissonance has a positive effect on the arousal of a) anger, b) guilt and c) regret.*

Anger, guilt and regret are differentiated by the effect that they have on the motivation to reduce dissonance (Beaudry and Pinsonneault, 2010, Davvetas and Diamantopoulos, 2017). Dissonance reduction may be achieved either by withdrawing the behaviour causing dissonance or by cognitive adjustments. In the context of decision-making, cognitive adjustment strategies include weakened regret, guilt and uncertainty about the decision and a strengthened resolution to stick to the decision made (Festinger, 1962). The state of anger occurs when people feel incapable of achieving the initial goal, which triggers the desire to change the goal orientation and switch to alternative options (Harmon-Jones, 2004, Carver, 2004). For example, the experience of anger, associated with the use of technology, negatively affects the determination to continue using the technology. Switching behaviour works as a defensive mechanism aimed at overcoming the occurrence of a similar negative outcome in the future (Beaudry and Pinsonneault, 2010). That means that the users of smart home technology who experience anger induced by the unsatisfactory performance of the technology are more likely to stop using the technology. Unlike anger, guilt was considered to be a strong determinant of attitude change. Since the feeling of guilt results from a moral dilemma, attitude change reflects a way to justify an action retrospectively and continue the behaviour by subduing negative emotions (Ghingold, 1981a, Kelman, 1979). Prior research confirmed the positive effect of guilt on the discontinued use of technology (Turel, 2016). Similar to anger, regret has a negative effect on continuous behaviour. Regret is aroused when an individual feels responsible for the choice, which induces the feeling of self-blame and undermines self-esteem. Self-blame underpins the

desire of individuals to avert the behaviour against the background of anticipated regret (Davvetas and Diamantopoulos, 2017). Therefore, we hypothesise that:

H3: *a) Feeling anger and b) feeling regret negatively affect dissonance reduction through cognitive adjustment, while c) feeling guilt positively affects dissonance reduction through cognitive adjustment.*

2.5.Outcomes of Dissonance Reduction

The rationale for the hypothesised relationships between the reduction of cognitive dissonance and satisfaction (in relation to technology use and purchase decision) is rooted in cognitive dissonance theory and the theory of cognitive consistency (Festinger, 1962). The discrepancy between expectation and actual perception leads to dissatisfaction and discomfort (Shahin Sharifi and Rahim Esfidani, 2014, Dutta and Biswas, 2005). Similarly, it can be hypothesised that the reduction of the discrepancy between two cognitions (i.e. expectation and perception) can potentially result in a heightened perception of satisfaction with the technology performance. Moreover, it is expected that dissonance reduction through cognitive adjustments (rather than behavioural withdrawal) is more likely to bring satisfaction with the decision, as people regulate their cognition by strengthening positive perceptions of the outcome. Hence, the following hypotheses are put forward:

H4: *Cognitive dissonance reduction through attitude change has a positive effect on a) overall satisfaction and b) decision satisfaction.*

3. Methodology

The study used a cross-sectional approach. The survey was distributed through a research crowdsourcing platform to the former and active users of smart homes who had had a negative experience instance with smart home technologies. The selection of the sample was conducted in two steps. The first step was to set the criteria for selecting respondents who used or had formerly used any smart home technology. This study did not focus on a specific device or system but rather aimed to recruit users of different types of smart home technologies (i.e. visual assistant, smart home security, smart alarms or leak sensors, smart lighting, smart plugs/switches, smart thermostat, smart home camera, smart vacuum cleaner,

smart lock, smart kitchen, smart tag and smart entertainment systems) to have wider implications from the findings. Secondly, to be eligible to participate in the survey, the selected smart home users had to have a negative experience (e.g. problems with installation or facing privacy and security risks) with smart home technology. To verify that respondents had issues with the technologies, they a) indicated the type of negative incident that they had experienced by selecting it among a predefined list or b) typed the nature of the incident if this was not already included in the list. The questionnaire was distributed to 800 people, out of which 474 valid responses were returned. The number of responses was deemed appropriate for running structural equation modelling (Hair, 2014). Table 1 presents the profile of the final sample of respondents. The sample comprised 47.9% male and 52.1% female. The majority of respondents were single (59.7%), with an age between 18 and 34 (71.3%), and an annual income equal to or less than 34,999 US dollars (44.5%).

Table 1: The profile of the respondents

Demographic Characteristic	**Type**	**Frequency (n=474)**	**Percentage**
Age	18 to 24 years	156	32.9
	25 to 34 years	182	38.4
	35 to 44 years	92	19.4
	45 to 54 years	31	6.5
	55 or older	13	2.7
Gender	Male	227	47.9
	Female	247	52.1
Education	Completed some high school	41	8.6
	Completed some college (AS-A-Levels)	135	28.5
	Bachelor's degree	188	39.7
	Master's degree	87	18.4
	Ph.D.	10	2.1
	Other advanced degree beyond a Master's degree	13	2.7
Income	Less than $25,000	116	24.5
	$25,000 to $ 34,999	95	20.0
	$35,000 to $ 49,999	79	16.7
	$50,000 to $ 74,999	78	16.5
	$75,000 to $99,999	53	11.2
	$100,000 to $149,999	38	8.0
	$150,000 to $199,999	8	1.7

	$200,000 or more	7	1.5
Marital Status	Single	283	59.7
	Married	163	34.4
	Separated	7	1.5
	Widowed	5	1.1
	Divorced	16	3.4

The questionnaire consisted of eight multi-items scales validated by prior studies. The disconfirmation scale was adopted from the study by (Bhattacherjee and Premkumar, 2004). For measuring cognitive dissonance the scale reflecting the wisdom of purchase developed by Sweeney et al. (2000) was used. The anger scale was adopted from the study by Harmon-Jones et al. (2004), the regret scale derived from the study by Tsiros and Mittal (2000), while guilt was measured by the scale developed by Coulter and Pinto (1995). To measure the reduction of dissonance through cognitive adjustments, we used the scale by Parguel et al. (2017). Decision satisfaction was measured by the scale adopted from Heitmann et al. (2007) and Fitzsimons (2000), whereas overall satisfaction was measured by the scale developed by McKinney et al. (2002). The items were measured by a 7-point Likert scale ranging between "1 - strongly disagree" to "7 – strongly agree".

For the analysis of the data, SPSS and Amos v.25 statistical tools were utilised. SPSS v.25 was used to produce descriptive statistics. Amos v.25 was employed to run confirmatory factor analysis and structural equation modelling. Confirmatory factor analysis demonstrated a satisfactory model fit ($\chi^2(467)$ = 1207.512, CMIN/DF = 2.588, CFI = 0.933, RMSEA = 0.058). Convergent validity, factor loading (> 0.7), Cronbach's α (>0.7), average variance extracted (AVE > 0.5) and construct reliability (C.R. > 0.7) confirmed the reliability and validity of the measurements (Hair, 2014) (table 1).

Table 1. Convergent validity test

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Disconfirmation	**0.826**							
Cognitive Dissonance	0.205	**0.824**						
Anger	0.217	0.477	**0.801**					
Guilt	-0.027	0.294	0.382	**0.783**				
Regret	0.244	0.599	0.492	0.528	**0.871**			

Decision	-	-	-	-	-			
Satisfaction	0.221	0.157	0.184	0.126	0.225	**0.788**		
	-	-	-	-	-			
Satisfaction	0.468	0.359	0.323	0.139	0.514	0.390	**0.859**	
Dissonance	-	-	-	-	-			
Reduction	0.320	0.162	0.144	0.019	0.197	0.405	0.547	**0.738**

Notes: Diagonal figures represent the square root of the average variance extracted (AVE) and the figures below represent the between-constructs correlations

4. Results and Findings

The model fit indices for the structural model were satisfactory ($\chi^2(486)$ = 1561.054, CMIN/DF = 3.212, CFI = 0.903, RMSEA = 0.068). That made it possible to embark on testing the paths of the research model. The model explained 5% of the variance for the feeling of cognitive dissonance, 39% of the variance for the feeling of regret, 11% for guilt, 25% for anger, 11% of the variance for the cognitive dissonance reduction, 20% for decision satisfaction and 36% for the satisfaction with technology performance.

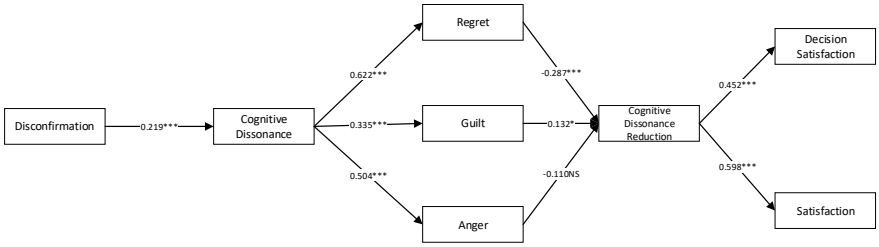
The results of the tests of hypotheses are provided in Table 2 and Figure 2. The results confirmed the significance of all the relationships, except for the one between anger and cognitive dissonance reduction. The significance and the direction of the relationships demonstrate the robustness and explanatory power of the proposed model. The path between disconfirmation and cognitive dissonance is significant and positive, confirming H1. The supported hypotheses H2a – H2c confirm that the arousal of dissonance triggers three types of emotions: anger, guilt and regret. A significant negative effect of regret and a positive effect of guilt on dissonance reduction support hypotheses 3b and 3c. Positive relationships between cognitive dissonance reduction and the satisfaction with the performance and decision were also supported (H4a, H4b).

Table 2. The results of the test of hypotheses

H	***Path***			***Coef.***	***(t-test)***
H1	Disconfirmation	--->	Cognitive Dissonance	0.219	(4.297***)
H2a	Cognitive Dissonance	--->	Anger	0.504	(9.074***)
H2b	Cognitive Dissonance	--->	Guilt	0.335	(6.179***)

H2c	Cognitive Dissonance	--->	Regret	0.622	(11.699***)
H3a	Anger	--->	CD Reduction	-0.110	(-1.869ns)
H3b	Regret	--->	CD Reduction	-0.287	(-4.661***)
H3c	Guilt	--->	CD Reduction	0.132	(2.225*)
H4a	CD Reduction	--->	Satisfaction	0.598	(11.535***)
H4b	CD Reduction	--->	Decision Satisfaction	0.452	(7.535***)

Figure 2: Structural Model



5. Discussion

The results of the analysis showed a significant and positive relationship between negative disconfirmation and dissonance. The positive effect of disconfirmation on dissonance arousal was in line with the Cognitive Dissonance Theory (Festinger, 1962). Disconfirmation reflects the inconsistency between prior beliefs about technology performance and the actual perception of performance, thus inducing a psychological state of dissonance (Szajna and Scamell, 1993). The established relationship between disconfirmation and dissonance suggests that performance issues were critical and the expectation-perception discrepancy could not be tolerated by users. The confirmed effect of negative disconfirmation on dissonance adds to the discussion raised by Park et al. (2015) and Park et al. (2012), who examined the consequences of inconsistency between the perception of pre-service and post-service performance. While they examined the discrepancy between the perception of services at different stages of technology use, the finding of this study provided evidence on the consequence of the incongruity between expectations and perceptions.

The positive effect of dissonance on anger, guilt and regret supported evidence from prior literature (Harmon-Jones, 2004, Harmon-Jones et al., 2017, Gosling et al., 2006, Gilovich et al., 1995b, Roese and Summerville, 2005). These findings made it possible to differentiate the effect of dissonance on each emotion independently, unlike the majority of prior studies, which focused on negative emotions in general (Jean Tsang, 2019, Gosling et al., 2006). The strength of the relationships demonstrated that the strongest feeling associated with dissonance was regret. The established effect of emotion suggests that individuals might have engaged in counterfactual thinking about a potential positive outcome of an alternative purchase decision (Croyle and Cooper, 1983). The significant relationship between dissonance and anger demonstrated that users did not feel in control and capable of using the technology the way they had initially expected (Harmon-Jones, 2004, Harmon-Jones et al., 2017). Given that anger is mostly experienced when people have low self-efficacy (Wilfong, 2006), the established relationship might suggest that weak technology performance was due to the personal inefficacy to perform the task. This explanation is also drawn from the profile of the respondents, who were mostly experienced users with high perceived expertise. This finding indicates that anger was not associated with a lack of experience with novel technology use, which could be accumulated along with the utilisation of technology. Rather, anger is related to the subjective evaluation of users' incapability of dealing with the issue. The effect of dissonance on guilt was lower compared to the other two types of emotion. Feeling guilt represents the state when people blame themselves for the violation of personal standards and norms (Harmon-Jones et al., 2017). The results suggest that improper technology performance might have disappointed users. They might have felt that they could not realise the potential of the technology they were fully in control of. Users might have had self-standards about technological self-efficacy, but they could not match up to those standards.

The findings supported the hypotheses that dissonance reduction is predicted by emotions (Festinger, 1962). The differentiated effect of each emotion on reduction demonstrated the complexity of negative emotions and its dissimilar role in behaviour. The relationship between guilt and dissonance reduction is consistent with prior literature suggesting its role in triggering psychological coping mechanisms, aimed at subduing the feeling of guilt (Kelman, 1979, Harmon-Jones et al., 2017, Ghingold, 1981b). Given that guilt undermines personal self-standards (Harmon-Jones et al., 2017), such as the belief in technological self-efficacy, this emotion predicts the change of cognition. The cognitive adjustment represents a coping mechanism reducing the feeling of inconsistency with one’s prior beliefs. By strengthening the positive attitude

towards technology and seeking positive information about the technology, users justified the adoption and reduced dissonance. The negative effect of regret on dissonance reduction through attitude change confirms the findings of recent studies postulating that regret facilitates behaviour change (Gilovich et al., 1995b, Davvetas and Diamantopoulos, 2017). In line with the study by Roese and Summerville (2005), the established correlations between regret and dissonance reduction demonstrated that self-blame and thinking about forgone alternatives decreased the value of the selected technology and demotivated continuous use. Given the effect size, of all the emotions, regret had the strongest power in regulating post-dissonance behaviour, suggesting that users gave a great deal of thought to opportunities that had been lost by refusing other alternative technologies. The relationship between anger and dissonance reduction was non-significant, which is inconsistent with the results of prior studies (Harmon-Jones, 2004, Carver, 2004).

The supported effect of dissonance reduction on the satisfaction with the performance and decision is in line with the assumptions driven by cognitive dissonance theory (Festinger, 1962). The significance of the relationships confirmed the assumption that the reduction/elimination of cognitive discrepancy and psychological tension (Festinger, 1962) contributes to satisfaction (Vroom and Deci, 1971). The confirmed hypothesised effects are consistent with a prior study which found a positive correlation between the tendency to favour a selected choice and satisfaction (Brehm and Cohen, 1962). Overall, the above findings provide two main pieces of evidence that have not been explored in the literature before. First, the findings confirm that despite negative incidents, the utilisation of smart homes may eventually be perceived positively. Second, evidence about the psychological and behavioural consequences of disconfirmation feeds into the likely scenarios in which weak technology performance may not result in discontinuous use.

6. Conclusion

The study theorised the outcome of the use of smart homes in conditions where the performance of the technology did not meet expectations. The research model produced results on a) the relationship of dissonance with anger, regret and guilt, b) the effect of the three types of emotions on the reduction of cognitive dissonance through cognitive adjustments, and c) the consequences of dissonance reduction in terms of the satisfaction with performance and decisions. The model

explained the role of anger, guilt and regret in the long-term utilisation of technology.

The results contribute to the current literature in three ways. First, the study adds to the expectation-disconfirmation literature by confirming satisfaction following a weak performance of the technology. A new insight was made possible by using the Cognitive Dissonance Theory to explain the conditions under which users facilitate their positive attitude, affective state about the technology and continuous use. Secondly, the findings add to the cognitive dissonance literature by shedding light on the interrelationship between cognitive dissonance, negative emotions and dissonance reduction. While prior literature examined negative emotions including anger, guilt and regret as a unidimensional construct (Jean Tsang, 2019, Gosling et al., 2006), this study breaks down the characteristics and dimensions of each emotion and distinguishes their motivational role in reducing dissonance. Third, the findings of the study add to the literature on the utilisation of innovative technology by providing evidence on the psychological factors affecting consumer experience with smart homes. The focus adopted by the study is different from other research, which has mostly examined the factors underpinning the adoption of innovative technologies (Pizzi et al., 2019). While prior literature examined the predictors of the decision and processes of innovative technology adoption (Rogers, 1995, Sabi et al., 2018), this research has investigated the behaviour of users after the appraisal of technology performance. In addition, this study provides practical implications. The understanding of smart home users' behaviour will help practitioners develop and market smart home products to increase their adoption in households.

The study has some limitations. First, we used a cross-sectional approach to test the research model. Future studies could examine the relationship between cognitive dissonance, emotions and dissonance reduction longitudinally. A longitudinal approach would make it possible to observe the change in emotions and behaviour over time, thus increasing the accuracy of the proposed relationships. Second, since we have established distinct effects of emotions on the reduction of dissonance through cognitive adjustments, future studies could examine the effect of emotions on other dissonance reduction strategies, such as behaviour withdrawal. That would complement the findings of this study and define the aversive role of emotions in behaviour.

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